SERVICEMAN'S

HAND BOOK

B-250 & B-275

TRACTORS

This book has been prepared for the convenience of servicemen who will be carrying out work on the B-250 and B-275 tractors. The contents consist of information on work that a serviceman is likely to be called on to do anytime, not necessarily overhaul.

Particular emphasis is placed on the single drop arm steering as used on the later B-250 tractors, which is not covered in preceding manuals. The introduction of CRPTO (constant running power take-off) in the B-275 has necessitated some information along this line which is also covered in this manual. Other information contained will be of interest to the serviceman working on these tractors.

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Tractor Specifications, B-250 & B-275

Engine:	B-250	B-275
Number of cylinders	4	4
Type of cylinder sleeve	wet	wet
Displacement	144 cu. in	144 cu. in.
Engine speed		
Full Load	1750	1875
High idle	1925	2225
Low idle	500	500
Compression ratio	19.3 - 1	19.3 - 1
Crankshaft		
Crank pin diameter	1.749 - 1.750 in.	1.749 - 1.750 in.
Main journal diameter	2.124 - 2.125 in.	2.124 - 2.125 in.
Number of main bearings	5	5
Main brg clearance	.0011 - .0041 in.	.0011 - .0041 in.
Main brg end clearance	.004 - .008 in.	.004 - .008 in.
Thrust taken on	rear main brg	rear main brg
Camshaft		
Running clearance	.0015 - .0035 in.	.0015 - .0035
End clearance	.008 - .017 in.	.008 - .017 in.
Number of teeth in drive gear	66	66
Number of bearings	3	3
Bearing journal diam. front	1.811 - 1.812 in.	1.811 - 1.812 in.
Bearing journal diam. center	1.577 - 1.578 in.	1.577 - 1.578 in.
Bearing journal diam. rear	1.499 - 1.500	1.499 - 1.500

Connecting rods		
Side clearance	.003 - .010 in.	.003 - .010 in.
Brg running clearance	.0015 - .0034	.0015 - .0034 in.
Bolt size and diameter	2" x .3715/375	2" x .3715/375 in.
Bushing bore	1.1028 - 1.1031	1.1028 - 1.1031
Pistons		
Length over all	3.897 in.	3.897 in.
Skirt clearance at bottom measured 90° from pin hole	.0048 - .0056	.0048 - .0056
Number of rings per piston	5	5
Width of ring grooves		
Compression ring, top	.0963 - .0969 in.	.0963 - .0969 in.
Compression ring 2nd	.0967 - .0973 in.	.0967 - .0973 in.
Compression ring 3rd	.0959 - .0965 in.	.0959 - .0965 in.
Scraper ring 4th (slotted)	.1877 - .1883 in.	.1877 - .1883 in.
Scraper ring 5th	.1877 - .1883 in.	.1877 - .1883 in.
Ring gaps		
Compression ring, top	.012 - .018 in.	.012 - .018 in.
Compression ring 2nd	.012 - .018 in.	.012 - .018 in.
Compression ring 3rd	.012 - .018 in.	.012 - .018 in.
Scraper ring 4th (slotted)	.012 - .018 in.	.012 - .018 in.
Scraper ring 5th	.012 - .018 in.	.012 - .018 in.
Piston compression rings		
Number of rings per piston	3	3
Width	.0930 - .0935 in.	.0930 - .0935 in.
Piston oil control rings		
Number of rings per piston	2	2
Width	.1860 - .1865 in.	.1860 - .1865 in.

Ring clearance in groove		
Compression rings top	.0028 - .0039	.0028 --.0039 in.
2nd	.0032 - .0043	.0032 - .0043 in.
3rd	.0024 - .0035	.0024 - .0035 in.
Oil control rings	.0012 - .0023	.0012 - .0023 in.
Piston pins		
Diameter	1.1023 - 1.1021	1.1023 - 1.1021 in.
Length	2.898 - 2.902	2.898 - 2.902 in.
Cylinder sleeves		
Diameter - inside	3.375 - 3.3762	3.375 - 3.3762 in.
Length	7.1/16 in.	7.1/16 in.
Maximum permissable taper	.0005 in.	.0005 in.
Maximum permissable out-of-round	.0008 in.	.0008 in.
Clearance, top surface of sleeve		
flange to top of crankcase	.003 minimum	.003 minimum
	.007 maximum	.007 maximum
Intake valves		
Stem diameter	.341 - .342	.341 - .342 in.
Port diameter	1.291 - 1.296	1.291 - 1.296 in.
Head diameter	1.465 - 1.475	1.465 - 1.475 in.
Tappet clearance, hot	.020 in.	.020 in.
Tappet clearance, cold	.020 in.	.020 in.
Stem clearance in guide	,002 - .004	.002 - .004 in.
Valve face angle	45 degrees	45 degrees
Valve seat angle	45 degrees	45 degrees
Exhaust valves		
Stem diameter	.341 - .342	.341 - .342 in.
Port diameter	1.072 - 1.077	1.072 - 1.077 in.

Head diameter	1.245 - 1.255	1.245 - 1.255 in.
Tappet clearance, hot	.020 in.	.020 in.
Tappet clearance, cold	.020 in.	.020 in.
Stem clearance in guide	.002 - .004	.002 - .004 in.
Valve face angle	45 degrees	45 degrees
Valve seat angle	45 degrees	45 degrees
Intake and exhaust valve guides		
Length - exhaust	3 in.	3 in.
intake	3.1/4 in.	3.1/4 in.
Diameter - inside	.344 - .345	.344 - .345 in.
Set height of guide	15/16 in.	15/16 in.
Intake and exhaust valve springs		
Outside diameter	.993 - 1.00 in.	.993 - 1.00 in.
Free length	2.17/32 ± 3/64	2.17/32 ± 3/64 in.
Test length	1.15/16 in.	1.15/16 in.
Test load	30 lbs.	30 lbs.
Valve timing		
Intake opens	10° before T.D.C.	10° before T.D.C.
Intake closes	42° after B.D.C.	42° after B.D.C.
Exhaust opens	42° before B.D.C.	42° before B.D.C.
Exhaust closes	10° after T.D.C.	10° after T.D.C.
Valve lever and shaft		
Valve lever shaft diameter	.748 - .749	.748 - .749 in.
Rimning clearance, valve lever on shaft	.002 - .004	.002 - .004 in.

Valve lever bushing		
Diameter, inside	.751 - .752 in.	.751 - .752 in.
Length	.990 - 1.00 in.	.990 - 1.00 in.
Valve Tappets		
Diameter	1.00 in.	1.00 in.
Length	2.5/16 in.	2.5/16 in.
Tappet clearance in guide	.005 - .003 in.	.0005 - .003 in.
Push rod diameter	.3095 - .3125 in.	.3095 - .3125 in.
Push rod length	10.775 - 10.868	.10.775 - 10.868 in.
Timing gears		
Backlash	.0011 - .0045	.0011 - .0045 in.
Idler gear to shaft clearance	.0010 - .0023	.0010 - .0023 in.
Lubrication system		
Pressure regulating valve - opening pressure	25 - 35 lbs.	25 - 35 lbs.
Lubricating pump		
End play - between gears and end plate	.0035 - .006	.0035 - .006 in.
Diameter clearance, gear to housing	.0053 - .0083	.0053 - .0083 in.
Backlash - between gears	.003 - .006	.003 - .006 in.
Backlash, between drive pinion and camshaft	.008 - .012	.008 - 0.012 in.
Drive-shaft running clearance	.001 - .0035	.001 - .0035 in.

Idler gear running clearance	.0053 - .0083	.0053 - .0083 in.
Drive shaft, length	11.1/16 in.	11.1/16 in.
Idler shaft, length	2.5/32 in.	2.5/32 in.
Idler shaft diameter	.4945 - .4955	.4945 - .4955
Clearance between oil pump body and drive pinion	.002 - .004	.002 - .004 in.

Lubricating oil filter

Type	full flow	full flow
Number used	1	1
Oil pressure regulating valve location	oil pump body	oil pump body

Lubricating oil pressure regulating valve spring

Free length	2. 11/32 in.	2. 11/32 in.
Test length	1.92 in.	1.92 in.
Test load	3.7 lbs.	3.7 lbs.
Outside diameter	.535 in.	.535 in.

Nut and Bolt toque date (foot pounds)

Cylinder head bolts	70 - 75	70 - 75
Connecting rod bolts	30 - 35	30 - 35
Main bearing bolts	70 - 75	70 - 75
Flywheel bolts	40 - 45	40 - 45
Manifold stud buts	25 - 30	25 - 30
Nozzle body stud nuts	30 - 35	30 - 35
Idler gear shaft nut	75 min	75 min
3 Crankshaft pulley nut	225 - 250	225 - 250
Tappet adjusting screw nut	20 - 25	20 - 25
Lubricating oil filter case bolt	10	10

Clutch:

Type	Spring loaded dry disc single stage	Spring loaded dry disc two stage
Size	10 in.	11 in. (main)
		9 in. P.T.O.
Springs used	12 (coil)	2 (Belleville washers)
Free length of springs	2.560 in.	
Test length of springs	1.688 in.	
Test load of springs	105 - 115 lbs.	
Clutch finger height from face of pressure plate	1.955 in.	3.475 in.
Clutch finger height from face of flywheel	1.955 in.	2.656 in.
Transmission		
Number of speeds		
Forward	5	8
Reverse	1	2
Speed range on 11.00 x 28 tires		
Forward 1st	1.158	1.5
2nd	2.554	2.5
3rd	4.039	3.97
4th	5.39	5.7
5th	11.89	6.7
6th		8.5
7th		10.7
8th		15.2
		22.7
Reverse	2.325	3.8
		10.1

Hydraulic System

Pump	Gear type	Gear Type
Pump capacity at 2200 RPM (engine)	5 gallons per min.	5 gallons per min.
Drive	from timing gears	from timing gears
Pressure	2150 (approx.)	2150 (approx.)
Valve	Single acting regular Double acting (attach)	Single acting Double Reg. Acting (attach
Remote control	single or double acting valve (attach)	single or double acting valve (attach
Hydraulic fluid	I.H. Touch control or I.H. Hy-tran fluid	I.H. Touch control or I.H. Hy-tran fluid
Reservoir capacity	2½ gallons	2½ gallons

Fuel system

Pump	CAV four plunger	CAV four plunger
Fuel delivery	3.9ccs per 100 plunger strokes at 850 R.P.M. (Max.)	

Tractor Dimensions

Length overall	112 in.	112 in.
Tread, front	48 - 76	48 - 76
Tread, rear	48 - 76	48 - 76
Height to top of steering whee	59-3/16 in.	60 in.
Wheel base	74-1/8 in.	74-1/8 in.
Ground clearance under rear frame	15-5/8 in.	15-5/8 in.
Drawbar height	12½; 14-3/4; & 17 in.	12½; 14-3/4; & 17 in
Lateral swing, each side of center	10 in.	10 in.
Weight (approx.)	3000 lbs.	3500 lbs.
P.T.O. speed	540 R.P.M.	540 R.P.M.
Battery - 2 required	1M585R	1M585R
Battery box size	8½ long x 7-1/16 wide 8-3/4 High (Top of Posts)	8½ long x 7-1/16 wide 8-3/4 High (Top of Posts)

ENGINE - B-275

When considering the differences between the BD-144 Engine as fitted in the B-250 and B-275 Tractor it must be remembered that basically the Engines are identical, No. of cylinders, bore and stroke, and displacements being the same.

There are, however, certain differences which should be noted and those are as follows: -

(1) Cylinder head cap screws replace cylinder head studs and Helicoil inserts are used in the tapped holes in the crank case. These can be inserted or removed quite simply with the special tools available. The advantages gained by the use of these inserts are twofold.

(a) There is a replaceable thread and (b) reduction in the torque loading of the capscrews

(2) A Helicoil insert is also used for the timing gear idler capscrew.

(3) The B-275 rear crankshaft oil seal has a larger casting which carries a one piece neoprene oil seal. The spacing of the holes of the oil seal casting differ from those of the B-250.

(4) The crankshaft differs from the B-250 in that two dowels are fitted and are offset to ensure correct fitting of the flywheel.

(5) Top and bottom rear main bearings are flanged to take the extra thrust imposed by the dual clutch. The crankshaft also differs in that the clutch shaft pilot ball bearing is carried in the crankshaft flange, and not a bush in the flywheel as in the case of the B-250.

(6) To obtain the increased horsepower, engine speed has been raised and is as follows: -

(A)	Low idle	575 RPM.
(B)	Full load	1875 RPM.
(C)	High idle	2100 RPM.

(7) Fuel pump govenor spring is of a greater length and slightly stronger.
Fuel pump idler valve spring is lighter.

continued

LUBRICATION

The primary function of the engine lubricating oil is the reduction of friction and wear. In addition it has the further important duty of cooling and sealing, cooling because it must remove much of the waste heat from the bearings, pistons and other working parts and sealing because the prevention of 'blow-by' of gas past the pistons depends ultimately on the oil film between the piston rings and cylinder walls.

The lubricating oil in the engine is distributed by forced lubrication. A full flow filter type is employed which filters all the oil passing to the working parts.

The following is a general description of the course of the oil. First it enters the main oil distributing gallery which is a drilled hole in the crankcase casting. From this it is conducted by separate leads to each bearing, passing through holes drilled in the casting to flood the working clearances around the crankshaft main bearings. The next stage is from the main bearings to the crank pins, and connecting rod big end bearings, through oilways drilled in the crankshaft. Oil reaching each big-end bearing lubricates it and passes outwards across the face of the crankpin to the ends, from which it is sprayed to all parts of the crankcase, a proportion reaching the cylinders to lubricate the walls, pistons and rings. The small end bearings are lubricated by means of splash thrown up from the connecting rod big ends. Branches are taken from the main gallery to lubricate the camshaft bearings and valve rockers.

The oil will fail in each respect as a lubricant, a coolant and sealing agent if its condition deteriorates too badly.

Two factors play a part in deterioration of the engine oil: first, contamination: second, oxidation or internal breakdown.

Generally speaking, the service life of a first class oil is limited more by contamination than by internal breakdown.

The main extraneous contaminates are:

(a) Airborne Matter - A certain amount of dust, grit and so on reaches the oil by way of the air intake and the crankcase breather.
(b) Unburnt Fuel - This gains entry to the crankcase from the cylinders, and its presence is largely due to incomplete combustion.
(c) Combustion Products - Substances formed during combustion of the fuel inevitably enters the oil. These include water and acids as well as the more obvious carbon.

Rust and other substances may enter the oil as a result of corrosive attack on cylinders and other metal parts by products of combustion.

LUBRICATION (Cont'd)

Some wear is inevitable. Minute fragments of metal are broken off the working surfaces and are removed by the scouring action of the oil.

The main effects of oil deterioration is wear which may be caused by the presence of hard solids in the oil or on the working surfaces, or by the collapse of the lubricating films through excessive thinning of the oil or obstruction of supply as a result of deposit formation or sludging.

Corrosion is promoted by acids and other products of oil oxidation or fuel combustion, but it can only take place if water is present. Cylinders are especially liable to suffer corrosion when the engine is running cold. Certain hard alloy bearings such as copper/lead, are also especially susceptible to corrosive attacks if acids are present.

The most generally observed indication of oil degradation is the formation in the engine of deposits of carbon, lacquer and so on, and the accumulation of sludge. Lacquer is mainly found on the pistons, around the rings and on the skirts in appearance like black paint or varnish. The main cause of this formation is due to high temperatures heating the oil. Two kinds of sludge can be found in the engine, those containing little or no water, and those containing water in substantial quantities. The former are largely composed of solid and semi-solid products of combustion and oxidation, together with dust, metallic particles and so on; these mixtures are generally pasty and sometimes resemble coffee grounds, whereas sludge containing water in substantial quantities resembles boot polish. The main source of water is vapour, formed during combustion, condensing when the engine is running too cold.

The viscosity of the oil can be changed by the influence of unburnt fuel; in the case of a kerosene engine the viscosity is reduced. In the diesel engine, dilution of the oil with unburnt fuel has much less effect on its viscosity, which usually tends to increase rather than decrease, owing to accumulation in the oil of combustion soot. In this case tendency of the oil to thicken is one of the reasons for changing it regularly.

The engine oil cannot prevent contamination of the crankcase with extraneous matter, nor can it escape partial destruction in and near the combustion chamber. A suitable oil should, however, make an important contribution to keeping in check its own degradation and the ill-effects that might follow. Where the lubricant must withstand conditions of extreme severity, as the highest level of performance is required, oils containing anti-oxidant additives are essential.

To keep the engine clean, a further property required of the

LUBRICATION (Cont'd)

oil is detergency, by which it is understood the ability to resist or reduce the formation of lacquer and other deposits on oil wetted surfaces, and to retain insoluble matter in suspension.

The cleaning action of a detergent oil extends to all parts of the engine with which it comes into contact, but the benefits are most marked where deposit formation is reduced on pistons, piston rings and cylinders. The performance of the engine is improved by reducing wear of these parts and by preventing the loss of power and excessive consumption of fuel and lubricating oil caused by choking or the sticking of piston rings.

The special properties of a detergent oil are clearly revealed not only at the metal surfaces but in the body of the oil where a powerful dispersant action takes place.

In an oil with inadequate detergency, particles of carbon and other insoluble substances tend to collect in clusters which gradually grow larger and eventually form deposits. In a detergent oil this coalescence is prevented, and deposit forming matter is kept harmlessly in suspension finely divided. A consequence is that detergent oils often go black, sometimes quickly. This blackening is no cause for concern, but shows that the detergent/dispersant additives are doing their work.

B-275 CLUTCH

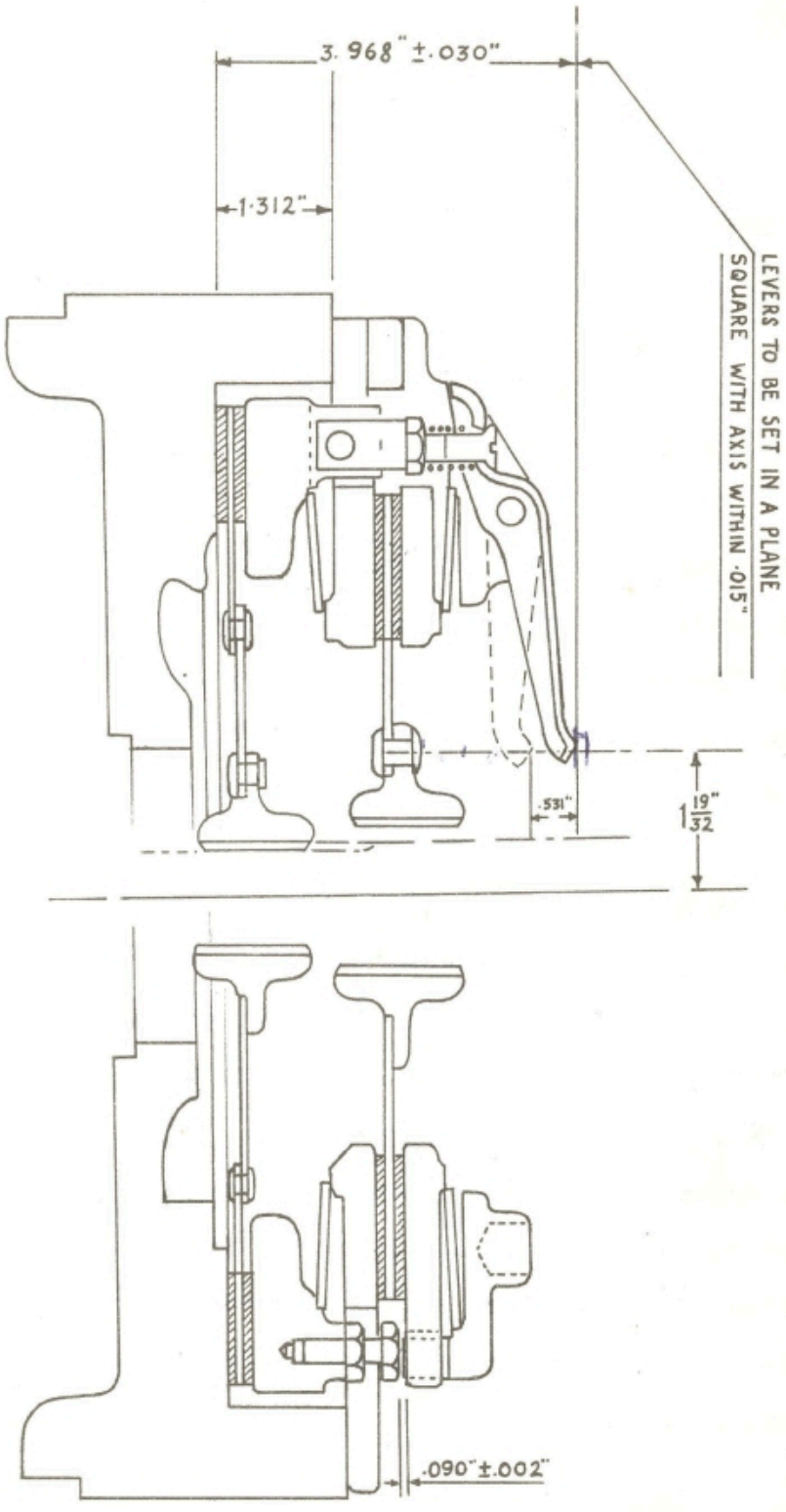
The engine clutch is a dual type fitted with Main Drive clutch plate 11" dia. and Power Take off clutch plate 9" dia.

Both Clutch plates are splined to their respective shafts, the main drive shaft running through the hollow P.T.O. shaft.

Replacing the orthodox coil springs are two Belleville Washers positioned between the main drive pressure plate and the flywheel plate in the main drive, and the P.T.O. pressure plate and the outer cover in the P.T.O. drive.

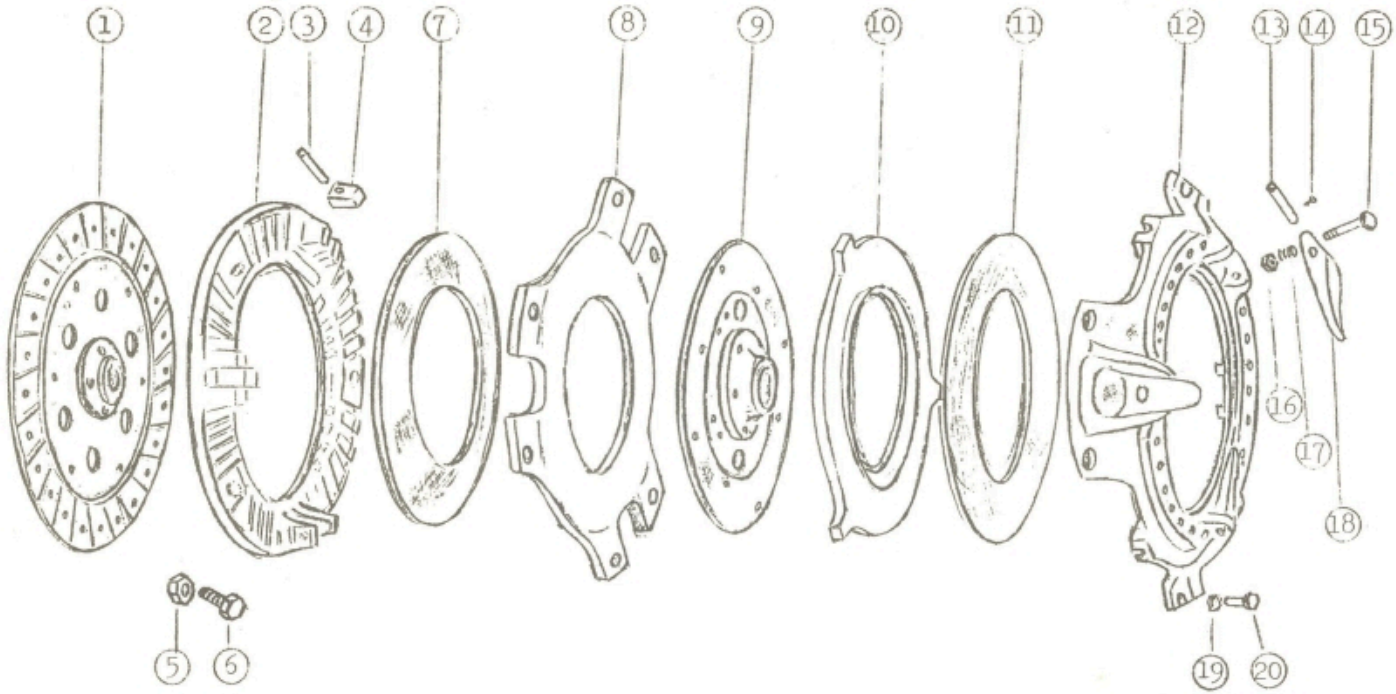
The outer cover carries three (3) clutch release levers which are depressed by a Carbon disc thrust plate actuated by normal clutch pedal operation.

Partial depression of the clutch pedal releases the main drive pressure place from the Main Drive Clutch driven plate thus freeing the transmission drive and leaving the P.T.O. still in operation. Pressure increased - Further depression of the clutch pedal moves the Main Drive pressure plate rearwards and by means of three (3) adjustable set screws, in turn, releases the P.T.O. pressure plate from the P.T.O. driven plate. The P.T.O. is then disconnected from the drive line.



SECTION OF 11" DUAL CLUTCH ASSEMBLY

EXPLODED VIEW OF DUAL CLUTCH

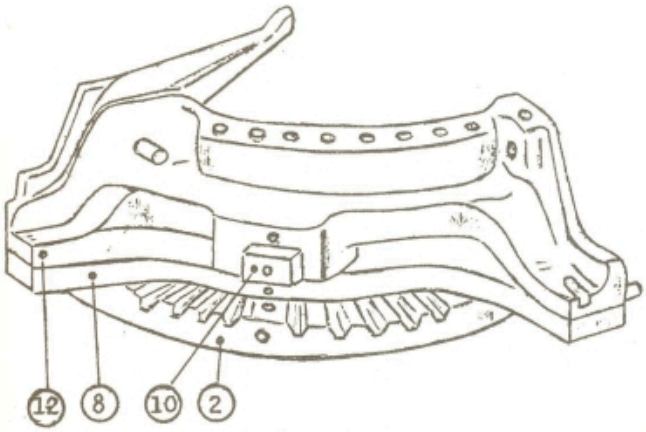


1. Main Drive Clutch
2. Main Drive Pressure Plate
3. Pin
4. Rod End
5. Lock Nut
6. Set Screw
7. Main Drive Belleville Washer
8. Flywheel Plate
9. Power Take Off Clutch
10. Power Take Off Pressure Plate
11. Power Take Off Belleville Washer
12. Outer Cover
13. Pivot Pin
14. Lock Pin
15. Adjusting Screw
16. Lock Nut
17. Anchor Clip Spring
18. Clutch Release Lever
19. Washer
20. Attaching Bolt

DUAL CLUTCH

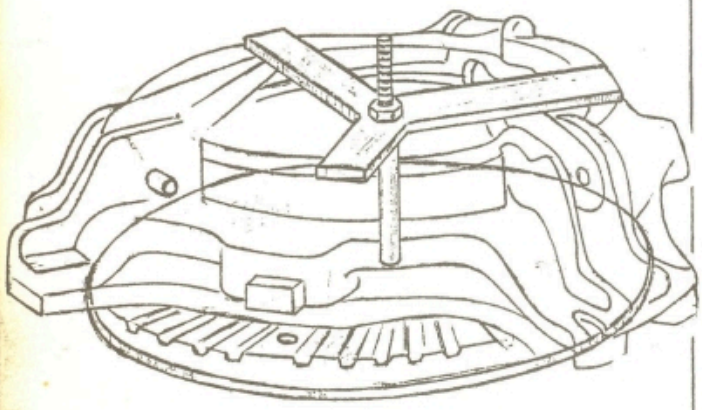
SERVICE INSTRUCTIONS

METHOD OF DISMANTLING



1.
In order to facilitate reassembling the clutch in its correctly balanced position the following items should be marked (e.g. with a centre punch).

(a)	OUTER COVER	(12)
(b)	POWER TAKE OFF PRESSURE PLATE	(10)
(c)	FLYWHEEL PLATE	(8)
(d)	MAIN DRIVE PRESSURE PLATE	(2)

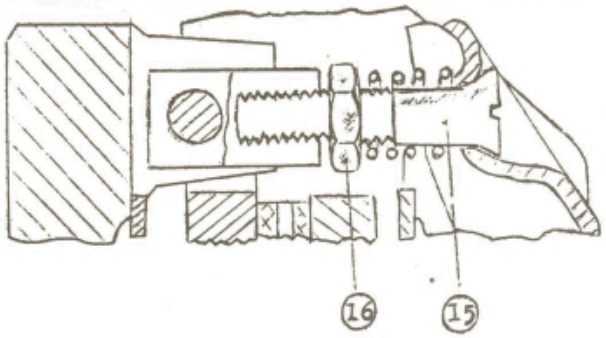


2.
Place the clutch in a fixture similar to that shown, with a 3 point clamp to plate across the OUTER COVER (12).

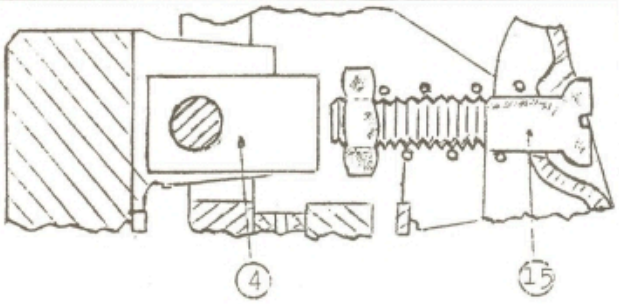
Tighten down the clamp plate until the CLUTCH RELEASE LEVERS (18) are free.

A Similar effect can be obtained by placing the whole under a press and applying load until the CLUTCH RELEASE LEVERS (18) are free.

NOTE: IMPORTANT If this method is used see special note in operation 4.



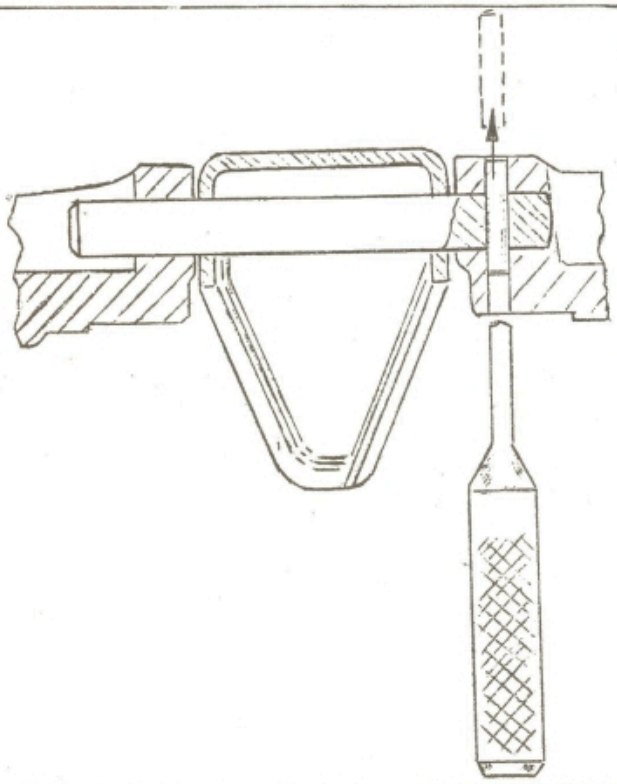
3.
Loosen LOCK NUTS (16) on ADJUSTING SCREWS (15).



4.
Unscrew ADJUSTING SCREW (15) out of ROD END (4), still holding nut (16) with spanner.

SPECIAL NOTE .If the disassembly is being carried out under a press the press load MUST NOT be released until all ADJUSTING Screws (15) have been released. If the load were released before all the screws had been unscrewed, damage would be caused to the remaining ADJUSTING SCREWS (15).

5.
Release load
Remove Clutch for dismantling



6.
Should it be necessary to renew the CLUTCH RELEASE LEVERS (18) or PIVOT PINS (13) it should be noted that each PIVOT PIN (13) is secured by a small LOCK PIN (14). This should be removed by driving it out of the OITER COVER (12) with a small diameter punch.

The PIVOT PIN (13) and CLUTCH RELEASE LEVER (18) can then be removed.
NEW LOCK PINS (14) should be used upon reassembly.

DUAL CLUTCH (Cont'd)

REASSEMBLY

The following should be noted before reassembly is commenced.

a) BELLEVILLE SPRING WASHERS
The clutch contains two of these, each identical in size and loading rate but identifiable by the coloured markings on each.

1. The MAIN DRIVE BELLEVILLE WASHER (7), i.e. as fitted to the 11" dia. clutch is marked with a stripe of RED paint.

2. The POWER TAKE OFF BELLEVILLE WASHER (11), i.e. as fitted to the 9" dia. clutch is marked with a stripe of YELLOW paint.

Care must be taken that each is fitted in its correct position as the one marked with the red stripe is of a special material.

b) LUBRICATING OF MOVING PARTS IN CONTACT

The points requiring lubrications before assembly are:

1. The driving lugs of the POWER TAKE OFF PRESSURE PLATE (10)

2. The driving lugs of the MAIN DRIVE PRESSURE PLATE (2)

3. The spherical seating of the CLUTCH RELEASE LEVER (18)

The following are suitable lubricants and should be applied as a light smear to the above components: -

1. LUBRIPLATE 70 grease (obtainable on Export Market only).

2. KEENOL KG20 grease) obtainable from Duckham & Co.Ltd.,

3. KEENOL KG15 grease) Hammersmith, London, W.6.

If these products are not available a MOLYBDENUM DISULPHIDE grease may be used.

METHOD OF REASSEMBLY

For reference to the enumerated parts refer to the exploded view. When assembled the parts should be in positional order as shown in this view.

1. On the work bench place the MAINDRIVE PRESSURE PLATE (2) face down in the fixture used during operation 2 of dismantling (or, if a press were used for dismantling the build up will be made on the work bench itself). If the SET SCREW (6), LOCK NUT (5), ROD END (4) and PIN (3) have been removed, these should now be re-assembled. Apply lubricating grease to the driving lugs.

DUAL CLUTCH (Cont'd)

2. Place the MAIN DRIVE BELLEVILLE WASHER (7) (marked with a red stripe) with its convex side uppermost, in its register on the MAIN DRIVE PRESSURE PLATE (2).
Care must be taken that is not dislodged during any subsequent operations.

3. Place the FLYWHEEL PLATE (8) in position lining up the punch marks made when dismantling the clutch. This must be assembled with the large chamfer downward.
Care must be taken that all grease and oil are wiped from the upper ground surface.

4. Place the POWER TAKE OFF CLUTCH (9) centrally onto the FLYWHEEL PLATE (8). This must be assembled with the flange of the hub upward.

5. Now set this sub-assembly on one side.

6. If the CLUTCH RELEASE LEVERS (18) have been removed, they should now be re-assembled into the OUTER COVER (12), using as previously advised, new LOCK PINS (14).
After fully inserting the LOCK PINS (14) the cast iron of the OUTER COVER (12) around the pin hole should be slightly bruised to prevent the LOCK PIN (14) escaping.
Apply lubricating grease to the spherical seating in the lever.

7. If the ADJUSTING SCREWS (15), ANCHOR CLIP SPRINGS (17) and LOCK NUTS (16) have been removed, these should now be re-assembled.
Pass the ADJUSTING SCREWS (15) through the hole in the spherical seating of the CLUTCH RELEASE LEVERS (18), fit the ANCHOR CLIP SPRINGS (17) onto the ADJUSTING SCREWS (15) then fasten on the LOCK NUTS (16).

8. Place the OUTER COVER (12) downwards on the bench, i.e. with the levers on the underside and the 3 legs facing upwards.

9. Place the POWER TAKE OFF BELLEVILLE WASHER (11) (Marked with a blue stripe) with its convex side uppermost, in its register in the OUTER COVER (12).
Care must be taken that it is not dislodged during any subsequent operations.

10. Place the POWER TAKE OFF PRESSURE PLATE (10) in position in the OUTER COVER (12) by lining up the punch marks made when dismantling the clutch. This must be assembled with the register downward.
Apply lubricating grease to the driving lugs
Care must be taken that all grease and oil are wiped from the upper ground surface.

11. (Cont'd)
Holding the whole of this sub-assembly together, invert and place on top of sub-assembly of the MAIN DRIVE PRESSURE PLATE (2) etc. previously set aside in operation 5. Once again the centre punch marks made during dismantling should be lined up in both sub-assemblies. Care must be taken that neither BELLEVILLE WASHER has been dislodged.

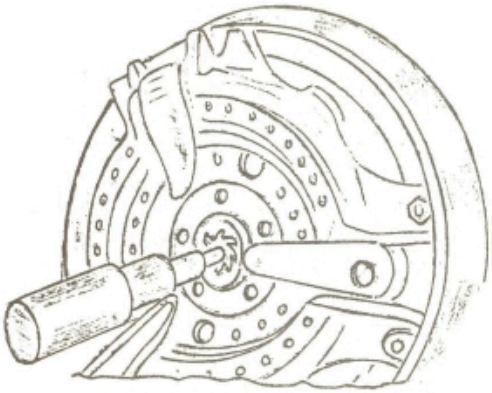
12. a. Place the 3 point clamp plate over the stud in the fixture and across the OUTER COVER (12). By means of the nut on the stud apply sufficient load such that the ADJUSTING SCREW (15) can be started in the screwed hole in the ROD ENDS (4) and then tightened part of the way down.

b. If using a press, a bar can be placed across the OUTER COVER (12) and the whole assembly placed under the press. Sufficient load is then applied such that the ADJUSTING SCREWS (15) can be started in the screwed hole on the ROD ENDS (4) and then tightened part of the way down.

NOTE: When using this latter method the press load MUST NOT be released until all the ADJUSTING SCREWS (15) have been tightened part of the way down. If the load were released before all the screws tightened into position damage would be caused to the ADJUSTING SCREWS (15) which were in position.

METHOD OF ASSEMBLING CLUTCH INTO FLYWHEEL

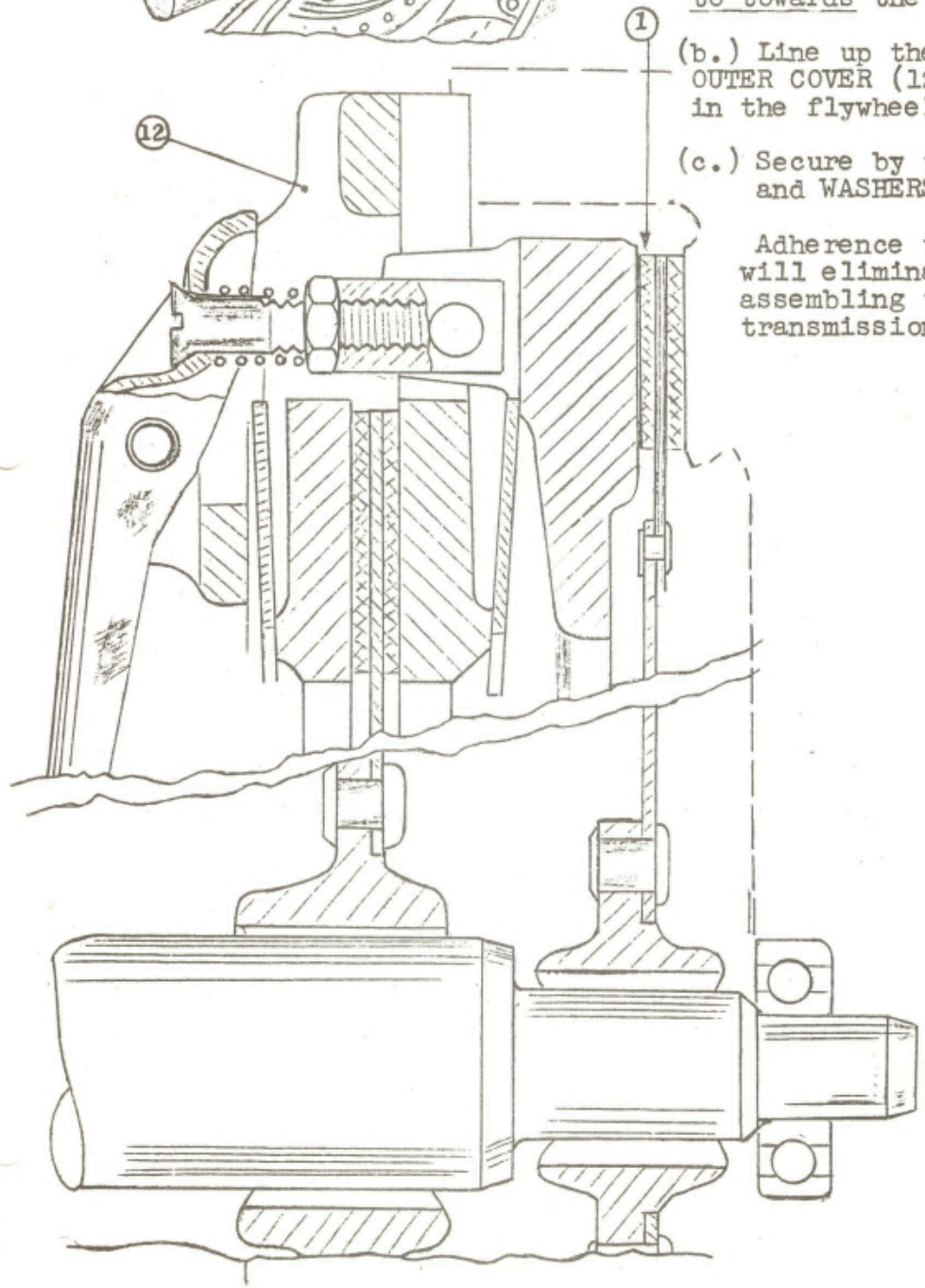
CLUTCH



1.

(a.) Assemble the MAIN DRIVE CLUTCH (1) and the CLUTCH ASSEMBLY by means of a PILOT TOOL which passes through the clutch hubs and locates in the pilot bearing in the flywheel.

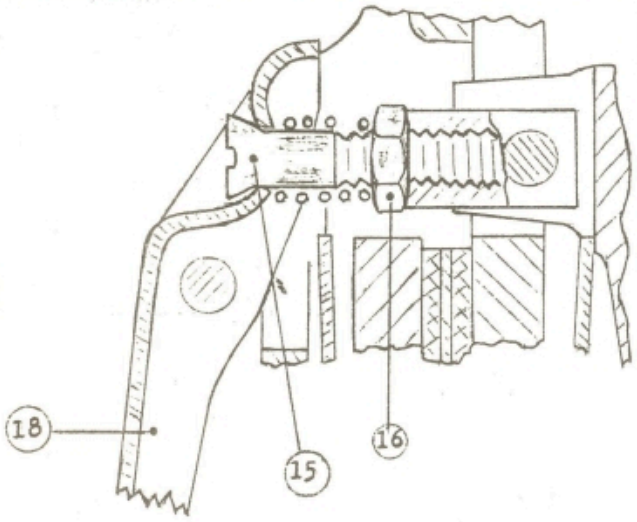
The MAIN DRIVE CLUTCH (1) must be assembled with the Flange of the Hub to towards the CLUTCH ASSEMBLY



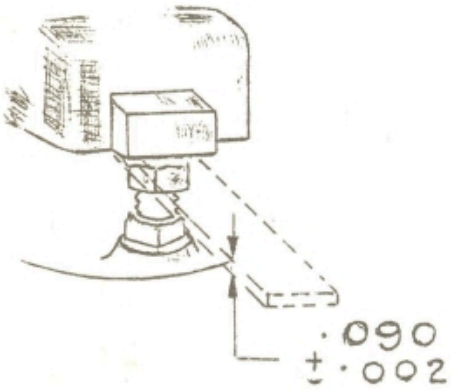
(b.) Line up the bolt holes in the OUTER COVER (12) with the tapped holes in the flywheel.

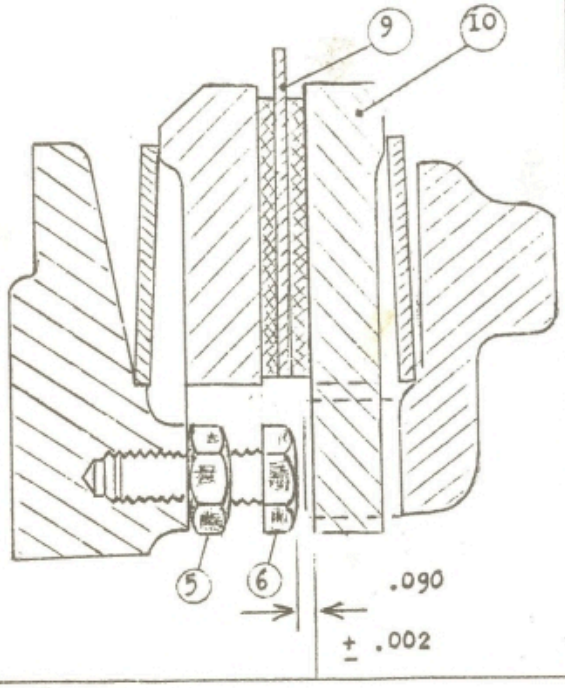
(c.) Secure by the ATTACHING BOLTS (20) and WASHERS (19).

Adherence to the above procedure will eliminate trouble when assembling the engine to the transmission case.



2.
The CLUTCH RELEASE LEVERS (18) should be set to their correct height (as indicated by a setting gauge) by loosening the LOCK NUTS (16), varying the ADJUSTING SCREWS (15) as required and refastening the LOCK NUTS (16).





3.
The SET SCREWS (6) under the POWER TAKE OFF CLUTCH PRESSURE PLATE (10) will require setting to a clearance of .090".

This is done by loosening the LOCK NUT (5), adjusting the SET SCREW (6) as required, then retightening the LOCK NUT (5).

The position of the SET SCREW (6) controls the point of release of the POWER TAKE OFF CLUTCH (9).

If there is too little clearance the POWER TAKE OFF CLUTCH (9) will be released too early, i.e. before the MAIN DRIVE CLUTCH (1) is released, thus the traverse of the tractor cannot be stopped without stopping the power take off.

If there is too much clearance it will be impossible to fully release the POWER TAKE OFF CLUTCH (9) although at the end of the clutch pedal travel it will still be impossible to stop the Power Take Off.

B-275 TRANSMISSION

DESCRIPTION

The main drive gear is integral with the transmission driving shaft, and takes the drive to the transmission from the engine clutch in conjunction with the clutch shaft.

The transmission driving shaft is suspended on a single row ball bearing which is housed in a cage which is bolted to the front of the main frame. Correct location is ensured by a close fitting flange into the bore of the main frame. End thrust is determined by ball-race thickness, and circlip inserted in shaft. The front end is supported by a ball-race fitted direct in the crankshaft.

The drive descends to the countershaft via the constant mesh train, the pinion being part of the transmission drive shaft, and the gear running on a floating cast iron bush between the I.D. of the gear, and the O.D. of the countershaft.

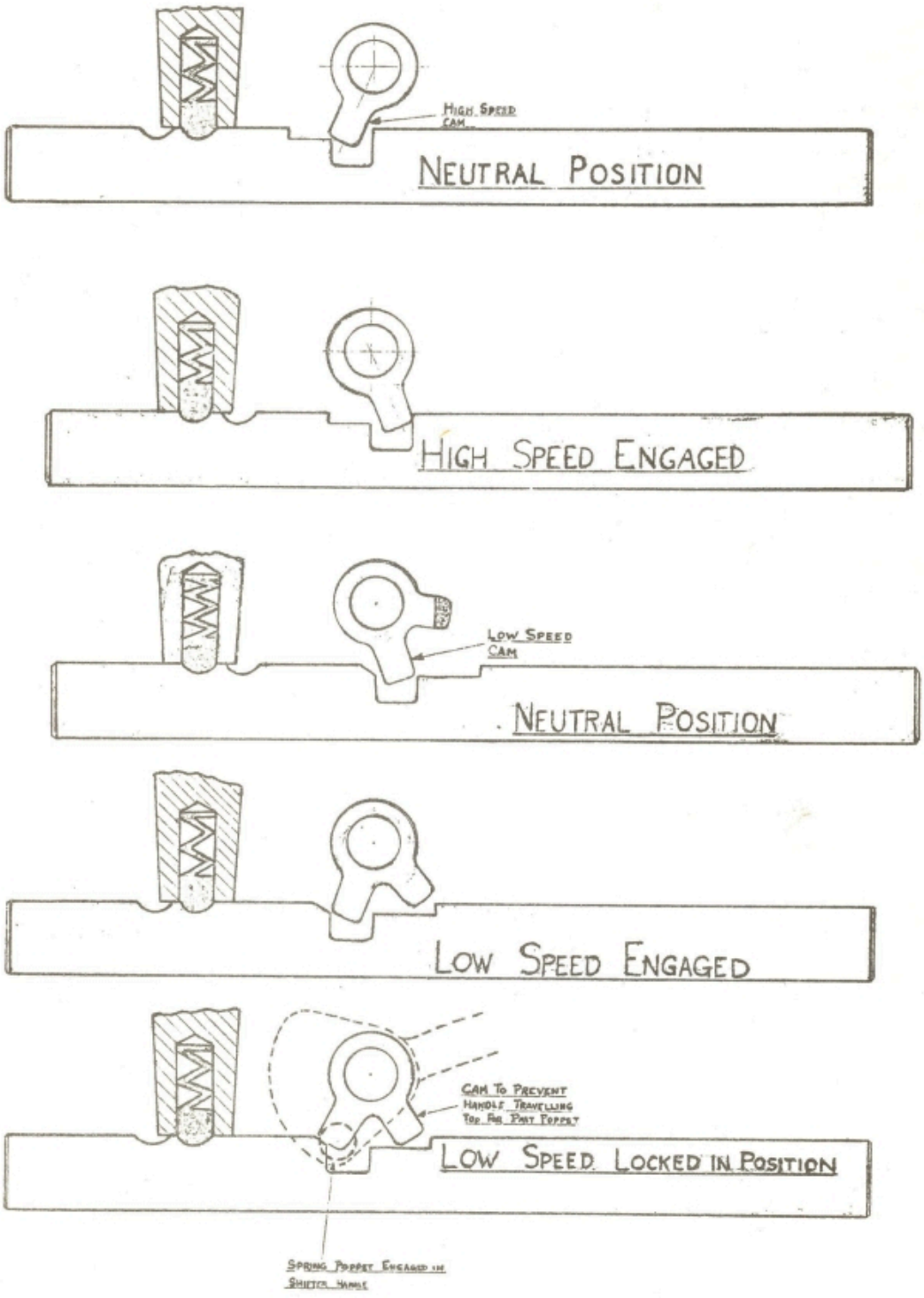
Incorporated with the constant mesh gear is a splined carrier for 1st countershaft ratio sliding gear coupling which engages with the 3rd and 4th speed driving gear dog thereby transmitting power through the countershaft to the selected gears. This gear train gives the low range speeds, at normal governed speed.

1st	L1	1-1/2 M.P.H.
2nd	L2	2-1/2 M.P.H.
3rd	L3	3-1/2 M.P.H.
4th	L4	5-1/4 M.P.H.

The transmission splined shaft is suspended on a double row tapered roller bearing at the rear, and a single row roller bearing at the front located inside the transmission driving shaft pinion.

Between the transmission splined shaft spigot and the splines, running on a double row roller bearing is a sliding quill gear which carries the 2nd countershaft ratio sliding gear coupling.

Selection of the Hi-Lo gear shift from Lo range to high


HIGH SPEED CAM
NEUTRAL POSITION
HIGH SPEED ENGAGED
LOW SPEED CAM
NEUTRAL POSITION
LOW SPEED ENGAGED
CAM TO PREVENT HANDLE TRAVELLING TOO FAR PAST DETENT
LOW SPEED LOCKED IN POSITION
SPRING DETENT ENGAGED IN SHIFTER HANDLE

B-275 TRANSMISSION-SHIFTER RAIL POSITIONS

B-275 TRANSMISSION (Cont'd)

DESCRIPTION

disengages the 1st countershaft ratio sliding gear coupling and in sequence engages the 2nd coutershaft ratio sliding gear coupling with the dog incorporated on the transmission driving shaft gear.

Selection of gears through this train gives the high speed range.

1st	H1	4-1/4 M.P.H.
2nd	H2	6-1/2 M.P.H.
3rd	H3	9-1/2 M.P.H.
4th	H4	14 M.P.H.

With the high range sliding gear coupling engaged and the low range disengaged, the constant mesh gear is permitted to run idle on the cast iron bush on the countershaft.

Power then is transmitted via the quill gear to the 4th speed sliding gear to the countershaft which is always in constant mesh with the 3rd and 4th speed driving gear.

The reverse idler shaft runs in two bushes at the side of the casting, and is retained by a circlip. The gear which is in permanent mesh with the countershaft is part of the shaft itself, whereas the gear which transmite the drive to the spline shaft has splines broached through it which mate with these on the shaft. Selection of reverse gear is obtained by the regular gear lever and Hi-Lo range whichever is required

Reverse Speeds

Low	2-1/4 M.P.H.
High	6-1/4 M.P.H.

TRANSMISSION

B-275 TRANSMISSION

ASSEMBLY PROCEDURE

1. Assemble and fit Coutershaft

2. Fit Reverse Shaft & Gear

3. Fit Countershaft, Rear Bearing, and Circlip, making sure that the Front Bearing Retainer Casting is in position - to hold the Countershaft rigid.

4. Place in position - the Pinion Shaft Retainer Bolts.

5. Fit Differential Assy- (7-11 lbs. Pre-load) inclusive of oil seal "drag".

6. Fit Pinion Shaft & Gears, Pre-load Brgs. 4-6 lbs. pull.

7. Fit Quill (Sliding Gear) & Hi-Speed Coupling Gears

8. Fit transmission Drive Shaft - IMPORTANT - Press down on countershaft and lift up on Drive Shaft to permit Dog Teeth to clear O.D. of Constant Mesh Gear.

9. Remove Countershaft Front Br'g Retainer and Fit Spacer - (Chamfer end to bearing) Bearing & Lock Sheet. Tighten up the Lock Nut - 30-35 ft. lbs.

10. Ensure there is slight end float (.004" - ,005") on Constant Mesh Gear (if too much end float - drive the Countershaft with a drift from the rear. Retighten Lock Nut - 30-35 ft.lbs.).

    IMPORTANT - (if insufficient end float suspect faulty parts or incorrect assembly of Countershaft Gear Train).

11. Fasten up remainder of gear box and Check B/L of Ring Gear & Pinion. Mated Gears - B/L etched on periphery of ring gear plus or minus .002".

B-275 TRANSMISSION

ASSEMBLY PROCEDURE (Cont'd)

12. Assemble Rear Axles and Bull Gears. Axle Casing C/screws 90 ft. lbs. Bull Gear C/Screws 280-300 ft. lbs.

13. Assemble Disc Brakes (5 Capscrews) 4-3-1/4" Long, 1-1-3/8" Long } Note Position

14. Assembly of Clutch Housing: -

    (a) Fit hollow tube Front Oil Seal

    (b) P.T.O. Driving Shaft with centre bearing fitted

    (c) Clutch Release bearing - Sleeve Carrier, & Cross Shaft

    (d) Fit Front & Rear Bearings on to Shaft

    (e) Push in Shaft from Rear

    (f) Fit Large & Small Circlips

    NOTE - Fit Circlip (Large) into Clutch Housing.
    Fit P.T.O. Bearing to Bore - tap in the Gear Boss through the Bearings, secure Gear to Bearing with Circlip (Small).

15. Fit assembled Clutch Housing to Transmission

    (Be Careful of Oil Seal)

16. Fit P.T.O. Shaft (Front)
    Fit P.T.O. Shaft Front Washer
    Fit P.T.O. Shaft Front Lock Washer
    Fit P.T.O. Shaft Front Nut-30-35 ft. lbs.
    Fit P.T.O. Shaft "O" Ring
    Fit P.T.O. Shaft Front Bearing Cap & Circlip

    NOTE:- Groove For Removal Purposes - Additional.

B-275 TRANSMISSION

ASSEMBLY PROCEDURE (Cont'd)

17. Fit P.T.O. Shaft (Rear) -

18. Gear Box Cover: - Assembling of:

Fit Hi-Lo Lever, Cross Shaft & Seal at same time (be careful with seal).

Assemble Cams on Cross Shaft - Single Cam on Left Side.

Double Cam on Right side.

NOTE: - The two legged Cam with apex of 'V' at 12.0 o'clock.
The single legged Cam - 9-0 o'clock.

19. Assembly of Shifter Rails: -

(a) Hi Speed Shifter Rail

(b) Blank Rail

(c) 4th and direct Speed Rail

(d) Gear Shifter Guide Rail

(e) 2nd and 3rd Rail

(f) Gear Shifter - Guide Rail

(g) 1st and Reverse

(h) Thich Guide Rail

(i) Lo Speed Fork and Rail

(j) Guide Bracket and Clamp

(k) Gear Selector Lever

NOTE: - Make sure Leading Edges of Couplings are in direction of engagement

20. Dismantle in Reverse Order

TRANSMISSION

B-275 POWER TAKE OFF

The main P.T.O. Drive Shaft is mounted in the P.T.O. shaft housing suspended between a ball race at the rear, and ball race at the centre. This is a quill shaft (hollow stem) running outside the transmission Drive Shaft. Integral with the quill shaft is a drive gear which transmits power to the constant mesh gear mounted in a ball race positioned in the lower half of the housing. The secondary P.T.O. shaft runs through the transmission countershaft suspended between a double row ball race at the rear and constant mesh gear at the front. The secondary shaft fits into a female spline transmitting the drive through the shaft to the final P.T.O. shaft at the rear. A dog clutch rides on the final P.T.O. shaft and is actuated by a spring loaded clutch lever. Two drillings in the main frame register the extreme movement of the lever. The dog clutch mates with splines on the end of the secondary shaft, completing the final drive.

HYDRAULIC SYSTEM

HYDRAULIC PUMP (GEAR TYPE)

This pump consists of two constant-mesh gears which rotate between two side plates and are surrounded by a pump body. Just enough clearance is left between the gears, the pump body and the two side plates to permit the gears to rotate freely and yet not to allow excessive oil leakage. The oil enters the intake side of the pump and, as the gears turn in their directions, the oil is entrapped in the spaces between the gear teeth, the pump housing and side plates. The oil is carried around the gears in the spaces between the teeth and is forced out as the teeth of one gear enter the spaces between the teeth of the mating gear. The oil which is being forced out of the spaces between the gear teeth is pumped out the discharge passage way. Very little leakage is permitted between the gear, pump housing and end plates, and for this reason the oil can be pumped out under pressure. After the gear teeth have fully meshed and the gear continue to rotate, the teeth will move out of the spaces between the mating teeth. This sets up a partial vacuum which causes the oil to fill the spaces between the teeth as the mating teeth move out. This partial vacuum is great enough to cause the oil from the reservoir to flow through the pump inlet, and fill the spaces between the gear teeth. Thus the oil which enters the pump inlet fills the spaces between the gear teeth and is carried around both gears until the teeth mesh; then it is forced out through the pump inlet. Gear pumps are simple in construction and will give years of satisfactory service in all hydraulic application. It is important to have the correct clearance between the gears and the pump housing and end plates. As this clearance increases due to wear, some loss of pressure will result, especially when one is pumping against extreme pressure.

GENERAL DESCRIPTION OF PLESSEY HYDRAULIC PUMPS

Plessey spur gear type pumps are of simple and robust construction, comprising only eight main components: body, bearings, gears and cover. The exposed end of the drive shaft is tapered, and fitted with a woodruff key, nut and lockwasher.

The pump is sealed internally by means of synthetic rubber cord rings, and the drive shaft by a standard flexible-lip type seal. The cover is secured to the body by eight screws and lockwashers.

Plessey pumps incorporate pressure-loaded bearings which compensate for wear and maintain minimum possible clearance between the faces of the gears and bearings, the cover end bearings being able, under the influence of oil pressure, to move longitudinally in the body for this purpose.

A duct is formed between the body and the bearings at the outlet or pressure side of the pump, so that oil under working pressure is forced through the duct and fills the space between the outer faces of the bearings and the inner face of the pump cover, thus creating an inward pressure which forces the bearings towards the gears.

The relief plate is surrounded by a cord seal ring and provided with a hole for the release of any oil under pressure that may seep past the seal. The hole connects with another duct formed between the body and the bearings.

DISASSEMBLY OF B-275 & B-250 HYDRAULIC PUMP

(1) Ease back the tab washers securing the shaft nut; hold the driving member in a vice and remove the shaft nut.

(2) Remove the gear from the shaft end by means of an extractor. If no extractor is available, support the gear firmly and give the shaft a sharp blow with a lead hammer or similar tool; then remove woodruff key.

(3) Remove eight screws around pump cover plate.

(4) Place shaft seal protecting sleeve on shaft end.

(5) Mark pump cover to body, then lift off cover.

(6) Remove pump body Cord Ring, Relief Valve plate and Cord Ring.

(7) Remove top bearings, using bearing extractor. Take care that both bearings are removed the same amount as locking wires are fitted in bearings. (Note position of bearings).

(8) Lift out gears. Note position of driving gear.

(9) If the bottom bearings are worn or damaged, remove using bottom bearing extractor. Note bottom bearings have locking wire fitted between bearings and their position in pump body. The condition of the pump bottom bearings may be observed through the pump bore and in most cases it will be found unnecessary to remove them. To remove the blanking plugs, detach the name plate and circlips, if fitted, and remove on a bench press or by tapping with a punch made of tufnol, fibre or other similar soft material.

Where the plug is retained with a circlip, this must first be removed before attempting to remove the plug. The plugs should not be removed unless external leakage from this source has been observed.
The shaft seal may be removed by pressing it from its cover after first removing the circlip if fitted.

RE-ASSEMBLY:

All components should be perfectly clean, and a clean work bench should be available. Care should be taken that any cleaning solvent used does not attack the rubber components. Paraffin or petrol is recommended.

It is necessary, usually, to renew all rubber sealing rings and the shaft seal.
Points to note during Assembly: -

(1) Parts should be scrupulously clean.

(2) Body bores and 'O' ring recesses should be free from burrs and bruise marks.

(3) Bearings should be free from burrs and bruises, particularly in bores and on flats. Oil grooves on bearing faces and bores should be free from foreign matter.

(4) Gear faces and journals should be free from corrosion and bruise marks.

(5) Shaft seal must be free from damage on the sealing lip.

(6) When used bearings are re-fitted, it will usually be possible to identify top and bottom bearings by observing witness marks on the rear faces, where the bearings have engaged the bottom of the pump and where the relief plate has been in contact with the top bearings. A little oil applied to the 'O' ring seals in the cover recesses will assist in assembly of the cover. Pumps must be assembled in the following manner: -

(1) Replace with new parts any plugs or shaft seals which have been removed.
N O T E: Where a plug is retained by a circlip the original plug may be re-fitted.
Where a plug assembly of the Non Circlip Type is employed it must be ring punched to spread the cord ring and thus ensure its retention.

(2) Assemble bottom bearings into body. The bearings should be held together with the flats in engagement, and the locking wires in position, the two bearings being offered

into the mouth of the body bores, with one bearing slightly in advance of the other. They will slide freely to the bottom of the bore. Rotate the bearings in the direction of rotation of the pump driven gear and press home the uppermost bearing.

(3) Assemble pump gears. Ensure that the drive gear is in the correct position.

(4) Inject a little hydraulic oil into the pump.

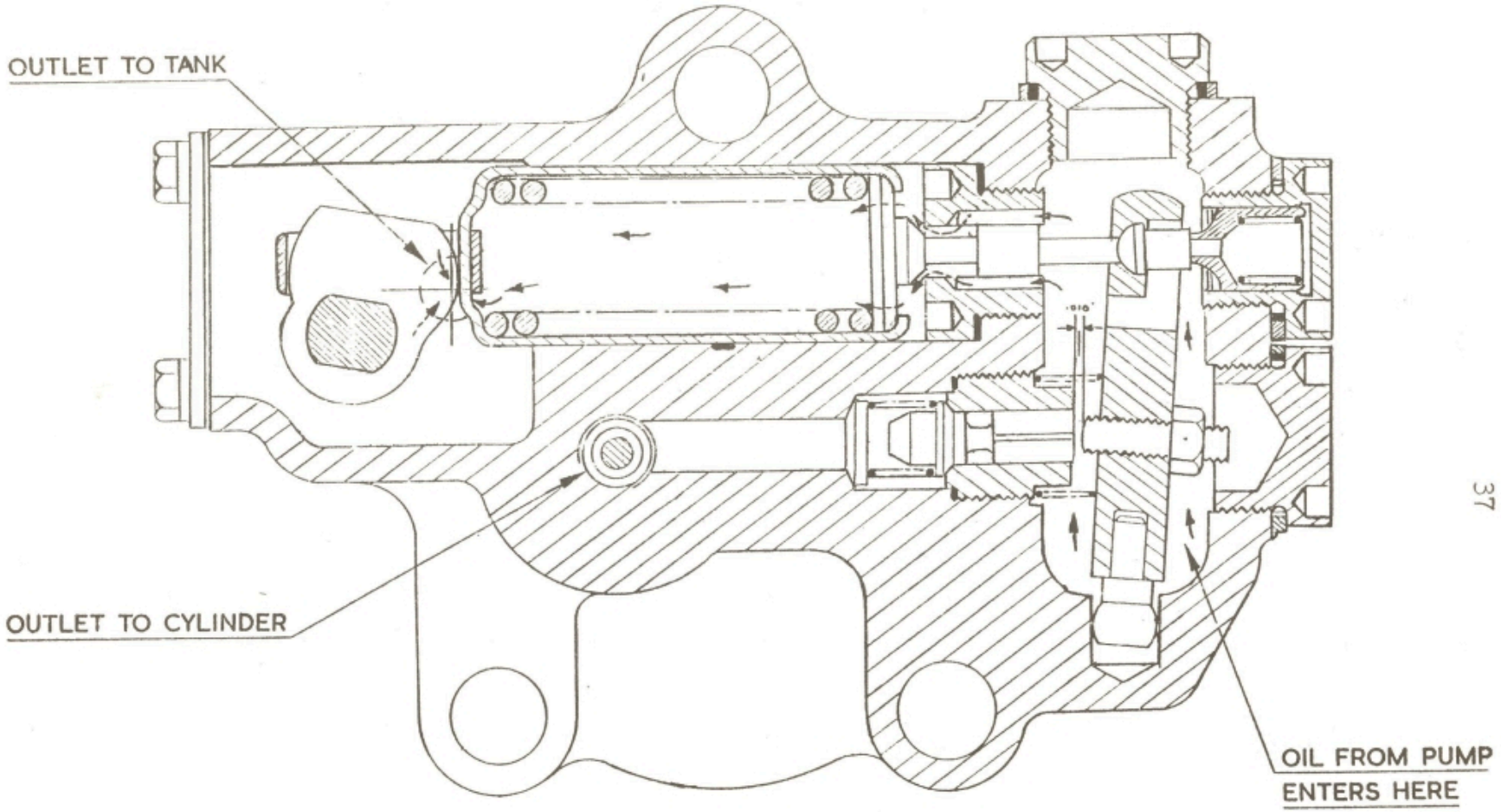
(5) Fit top bearings adopting the same technique as for the bottom bearing and rotate in the same direction.

(6) Fit cover 'O' ring together with relief plate and 'O' ring. Care should be taken that the relief plate is assembled on the inlet side of the pump.
N O T E: In the event of a new gear and/or bearings being fitted, ensure that the pressure relief plate is below the surface of a straight edge laid across the top of the pump body by not less than 0.003 in. and by not more than 0.0055 in. Relief plates are obtainable to give the correct requirements.

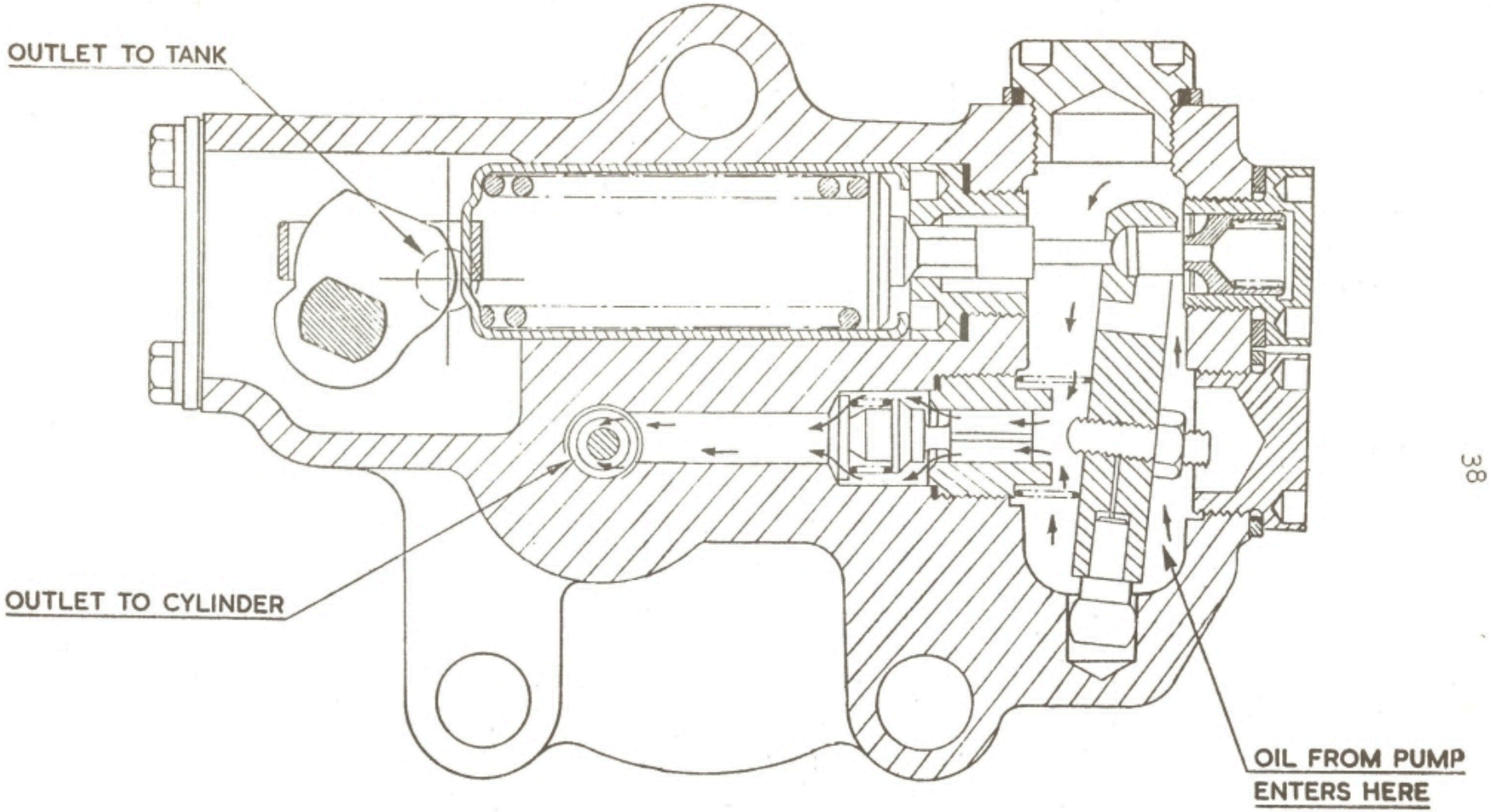
(7) Replace pump cover (using protecting sleeve) over shaft to avoid damage to seal.

(8) Fit screws and washers and tighten evenly and securely. Note position of screws for seal.

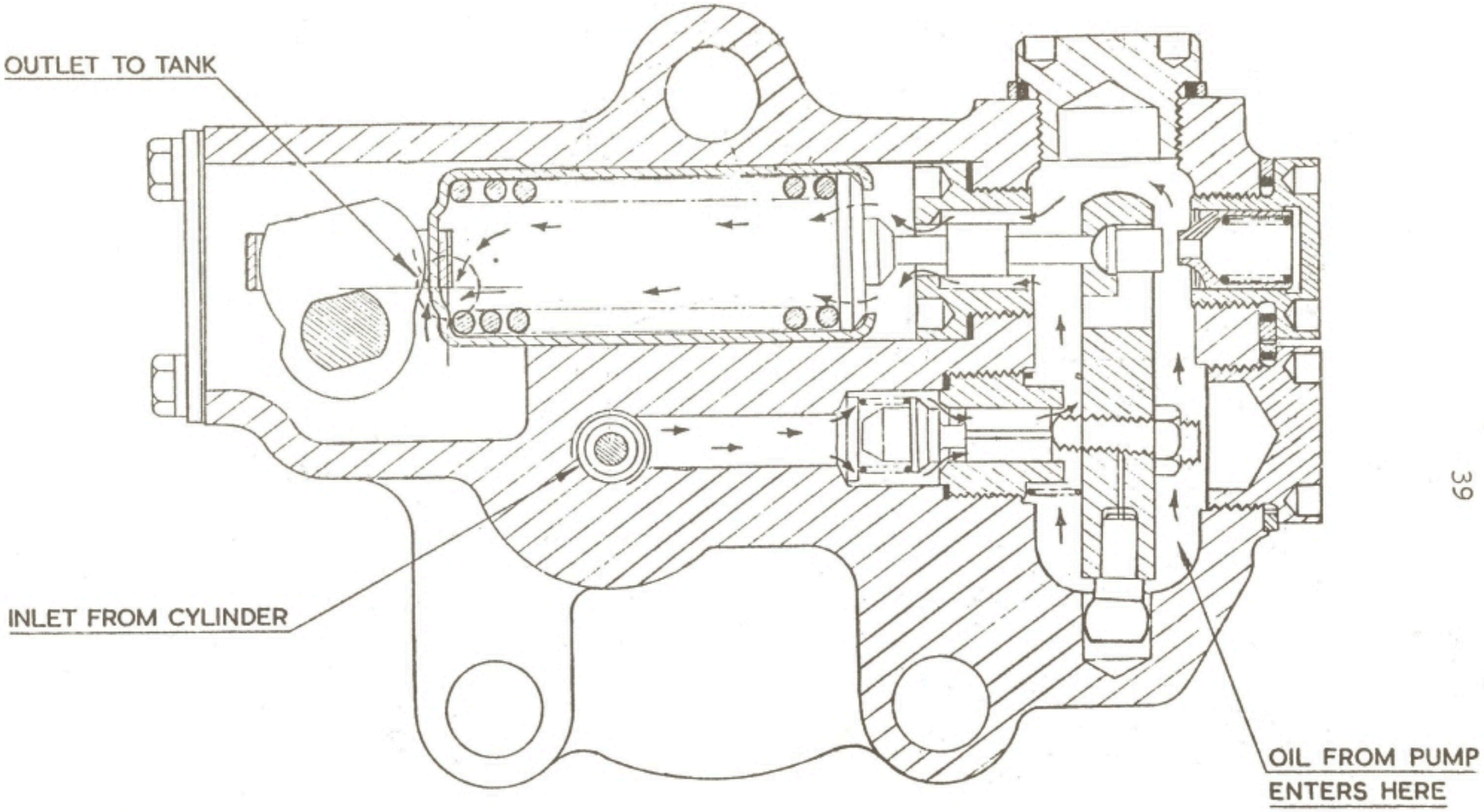
(9) Assemble gear to pump shaft after key has been fitted. This should be offered up by hand, not by tapping into position. Lock the tab washer.



SELECTOR VALVE IN NEUTRAL POSITION



SELECTOR VALVE IN LIFT POSITION



SELECTOR VALVE IN LOWER POSITION

HYDRAULIC SYSTEM

CONTROL VALVE

Before the Control Valve can be removed from the tractor, the hydraulic system must be drained. The draining of the system has been dealt with in the Operators Manual.

DIS-ASSEMBLY

(1) Remove isolating valve.

(2) Remove topping nut, bolt plugs and dashpot.

(3) Remove adjusting screw.

(4) Remove cover plate and gasket.

(5) Remove operating lever pin.

(6) Remove operating lever.

(7) Depress and slide out intercouple lever from the relief valve to allow relief valve assembly removal.

(8) Tap out relief valve assembly until cam is removable.

(9) Place safety collar over relief valve stirrup before withdrawing from housing. TAKE GREAT CARE NOT TO STAND OPPOSITE THE HOUSING. A faulty stirrup allows spring to expand and may push against cover plate. Any such pressure must be overcome by relieving pressure with two long capscrews in cover plate. On no account remove cover plate unless this condition has been checked for first.

(10) Remove relief valve seat and washer.

(11) Slide out intercouple lever. Remove supporting spring.

(12) Unscrew non-return valve. Shake out copper washer.

(13) Remove non-return valve spring and stop plate/

ASSEMBLY

(1) Insert copper washer 705 996 R1 and Relief Valve Seat 705 995 R1 using special peg spanner. Washer should be annealed prior to positioning. Apply maximum torque to Relief Valve seat, to compress washer.

(2) Using pointed pliers insert non-return valve stop 706 020 R1.

ASSEMBLY cont'd.

(3) Drop non-return valve spring 706 021 R1 into position above stop.

(4) Drop copper washer 706 018 R1 into place within housing, having first annealed it.

(5) Place non-return valve 706 021 R1 into its seat 706 017 R1 and, holding the pin of the valve through the seat using pointed pliers, insert into housing. Tighten seat with 5/16" W box spanner.

(6) Place intercouple lever support spring 706 019 R1 into position over valve seat.

(7) Position intercouple lever 706 009 R1 with spring depressed. Spring then is positioned behind lever. The slot of the lever must be to the exterior to allow the relief valve stem groove to locate in the slot. (When relief valve assembly has been positioned the lever moves fully into its housing seat and position).

(8) Insert relief valve sub-assembly 705 997 R91 into position taking EXTREME care not to remove safety collar until valve assembly is within its housing. Line up the intercouple lever with the relief valve stem. Locate the groove into the intercouple lever slot and then fully position the intercouple lever into its housing. The relief valve assembly is then correctly assembled to the intercouple lever.

NOTE: The relief valve spring has a 3.7/8" free length loaded to 250 lbs. the compressed length is 2-3/4". It is held at this load by a stirrup, the lips of the stirrup positioning the relief valve and retaining the spring.

This complete assembly 705 997 R91 requires the following essential safety precaution: -

SAFETY PRECAUTION

It is imperative that the ends of the spring stirrup should not be allowed to open, permitting the spring to expand and eject the valve.
A SLEEVE OF 1¼" DIA. MUST BE SLIPPED OVER THE STIRRUP ADJACENT TO THE VALVE.
When the stirrup opens the whole spring is able to fly free and COULD SERIOUSLY INJURE a fitter dis-assembling the part to be replaced.
The separate parts are listed in the Parts List.

(9) Position cam 706 020 R1 into the cam stirrup with the "Voo" groove to the outer cover 706 006 R1. Centralise the cam into the operating lever bore using the special tool. Hold the relief valve assembly at this position and place operating lever 706 003 R91 within cam. Work the lever to ensure free movement. Secure into housing with Pin 706 005 R1 allowing pin to locate in lever pin groove.

(10) Fit cover gasket 706 007 R1 and cover plate 706 006 R1 into position with four capscrews ¼" x 5/8" and lock washers. Use 3/16" W Box spanner to tighten down.

(11) With lever in "Lift" position insert adjusting screw 22 249 with lock nut into the intercouple lever using 1/8" Allen key to tighten screw down until it contacts the non-return valve. Back off one-and-a-third turns and tighten down lock nut. This adjustment affects the control lever action and determined "Lift", "Drop", or "Hold" in relation to the non-return valve position.

(12) Insert dashpot assembly and washer.

(13) Insert the two plugs with their washers and tighten with peg spanner ("Tools").

SAFETY PRECAUTION cont'd.

(14) Insert plug 706 027 R1 and washer into housing.

(15) Position isolating valve assembly 706 029 R1 into housing and secure with capscrews. Use a 3/8" W thin ring spanner. Tighten until stop plate is positioned.

NOTE:
A change has been made to the isolation valve to overcome the difficulty of sealing down the earlier design against the valve seat pressure. Assembly of both valve types remains identical.

HYDRAULIC UNIT

After the hydraulic unit has been removed from the tractor the following procedure should be adopted for the dismantling and assembling of the unit.

DISMANTLING:

(1) Remove Control Valve. Unlock the locks securing the capscrews which hold the lift arms to the rocker shaft.

(2) Remove both lift arms. Mark their position.

(3) Remove the plug and oil filter.

(4) Remove the cover plate and gasket.

(5) Remove the suction filter.

(6) Disconnect the connecting rod from the rocker arm.

(7) Unscrew both locking screws from the rocker arm and depth control arm.

(8) Using suitable dolly, remove the rocker shaft with seal, distance piece and bushing from both sides.

(9) Remove the by-pass filter.

(10) Withdraw piston and cylinder.

(11) Punch out pin holding the depth control knob to shaft.

(12) Unscrew the three capscrews from the cover which retains the depth control shaft,

(13) Remove depth control shaft and spring assembly.
Before the unit is assembled the following points should be noted: -

(1) The hydraulic unit should be thoroughly cleaned inside and outside.

(2) All seals will be renewed.

(3) The inside of all plugs should be coated with Red Sealer.

(4) The unit to be inspected for any visual cracks or damage.

(5) Inspect Piston and Cylinder for wear, cracks or score. marks and piston relief valve.

(6) Red Sealer should NOT be used on any threaded components.

(7) The cover plate gasket must be assembled with a high grade clear gasket sealer.

(8) All capscrews to be tightened to the torque specified.

(9) All '0' rings must be renewed.

(10) Care must be taken to ensure that the hole in the by-pass filter accurately aligns with the hole in the control Valve. On later models these are located with a dowel.

ASSEMBLY:

(1) Reposition spring assembly and shaft into the hydraulic unit.

(2) Replace the cover and gasket which support the depth control shaft. Torque up capscrews.

(3) Secure the depth control knob to the shaft.

(4) Position rocker arm and depth control cam in unit.

(5) Slide in rocker shaft noting positions of splines.

(6) Lock the rocker arm and depth control cam to the rocker shaft with the lockscrew.

(7) Fit connecting rod to rocker arm.

(8) Fit both rocker shaft bushes to the unit using the dolly.

(9) Fit spacers to both sides.

(10) Position both seals noting the position of the lip and using the suitable dolly.

(11) Reposition the lift arms and replace washers, locks and capscrews.

(12) Fit the cylinder and piston into the unit.

(13) Fit the by-pass filter, noting the position of the hole in the filter.

(14) Fit the suction filter.

(15) Raise and lower the lift arms to ensure that they move freely.

(16) Reposition cover plate gasket and cover plate ensuring that a suitable sealer has been used. Torque up the capscrews.

(17) Lock the capscrews which retain the lift arms to the rocker shaft.

(18) Replace oil filter and plug.

(19) The Hydraulic Unit is now ready for the Control Valve to be assembled.

(20) Fill system with IH HI-Tran or Touch Control oil.

STEERING & WHEELS

ELEMENTS OF STEERING

Introduction:

The designer endeavours to evolve a system whereby the wheels are, at all times, in true rolling motion without rubbing or scraping (known as scuffing) of the tires on the ground. At the same time the steering must be easily handled, and have a certain amount of self-centering action.

Brief Description of Steering Mechanism Components

Steering Knuckles- Subsidary axles attached to the main axle beam on which the wheels are mounted. Steering Knuckle bushes set as far apart as possible to reduce angular play to a minimum.

Steering Arms- Attached to each steering knuckle (mounted on ball and socket joints).

Drag Link- Attached on near side of tractor between steering arm and the drop arm (mounted on ball and socket joints).

The steering mechanism is built up in this way to provide a leverage between the steering wheel and the steering knuckles, so that a relatively large movement of the steering wheel is required for a small movement at the steering knuckles.

Ackerman Angle- When a tractor is turning from the straight ahead position, it describes a circle around a point somewhere on the centre line of the rear axle. If true rolling motion without tire scuffing is to be maintained, the imaginary lines drawn through each front wheel axis should both interest on this line. Therefore although the front wheels are parallel in the straight ahead position, they are not parallel when the tractor is turning. The greater the lock of the wheels, the greater the deviation from parallel.

This problem is solved by Ackerman principle in which the steering arms are so fitted that lines drawn through their tie rod connections and centres of their steering knuckles intersect somewhere on the centre line of the tractor near the rear axle.

ELEMENTS OF STEERING

Ackerman Angle (cont'd)

The included angle is called the Ackerman angle, and it will vary with the track width and the wheel base of the tractor.

This inclination of the steering arms enables the inner wheel to turn through a greater angle than the outer wheel when the tractor is on the turn.

The Ackerman principle is not actually correct for all positions, but is sufficiently near cofrect for general practice.

Caster Angle- An important feature of good steering is the tendency for the tractor to straighten up on the self-centering effect which is produced by the caster trail angle. The steering knuckle is inclined to the vertical in the fore and aft direction, backwards at the top and forwards at the bottom. By this means the wheels are "trailed" and tend to return to the straight ahead position.

King Pin (Steering Knuckle) Inclination - The Steering Knuckle is inclined outwards away from the centre line of the tractor at the bottom and inwards towards the centre at the top. The object of this tilt is to enable the axis of the steering knuckle to intersect the almost vertical centre line of the wheel where the tire contacts the ground.

If the tire made point contact only with the ground we would have "centre point steering". In practice, however, the tire spreads on contact with the ground, therefore, only an approximation to the ideal can be obtained. The best approximation being when the near vertical lines of the wheel and steering knuckle intersect on the ground centre point.

Steering knuckle inclination assists the caster effect with self-centering, raising the front of the tractor, the weight assisting with the return to straight ahead position.

Wheel Camber - To assist Steering Knuckle inclination and to distribute the load on the wheel bearings. The wheels are inclined, the resulting "camber" being the reverse to Steering Knuckle inclination.

ELEMENTS OF STEERING

Front Wheel Track -When the front wheels have camber there is a tendency for the wheels to "run out". To conteract this, the wheels at hub centre height are closer together at the front than at the rear. This is known as "toe-in".

Conclusion - From the above it will be realised that Caster Angle, King Pin Inclination, Wheel Camber, and Front Wheel Track ("Toe-in") are all closely related, and alteration to any one may effect the others.

FRONT AXLE

Disassembly and Inspection of Front Axle.

Removal

1. Disconnect the battery ground cable.
2. Lock the brakes and raise the front end of the tractor to take weight off the front axle.
3. Remove the cotter pin and nut securing the Drag Link to the L.H. steering knuckle arm. Remove Drag Link.
4. Drive out the groove pin, securing the front axle pivot pin to the axle support, and drive out the pivot pin from the axle support.
5. Raise the front of the Tractor and pull the axle assembly clear.

Disassembly

1. Remove the wheels.
2. Remove the cotter pins and nuts securing the Tie Rod to the Steering Knuckle arms. Remove Tie Rod.
3. Remove the clamp bolts from each steering knuckle and pry the arm off the steering knuckle shaft. Remove the Key from the Steering Knuckle shaft and withdraw the steering knuckle from the front axle assembly.
4. Press out the steering knuckle bushes from the front axle assembly and the pivot pin bushes from the pivot pin sleeve if they are to be replaced.

Inspection of Front Axle.

1. Thoroughly clean all parts with varsol and dry with compressed air.
2. Inspect the Front axle pivot pin for wear.
3. Inspect the steering knuckle shafts for wear.
4. Inspect the steering knuckle thrust bearings for wear or damage.
5. Inspect all bushings for wear or damage.

STEERING & WHEELS

FRONT AXLE

Disassembly and Inspection of Front Axle (Cont'd)

Reassembly of Front Axle

1. Fit and Ream any bushes that required replacement on inspection.

2. Assemble a thrust bearing on each steering knuckle shaft and insert the shafts into their bushings in the front axle assembly. (Grease all bushings as assembled).

3. Fit a key to each steering knuckle and line up the keyway in the steering knuckle arm. Drive on each steering knuckle and tighten the clamp bolts.

4. Assemble the Tie Rod to the steering knuckle arms, tighten nuts and fit cotter pins.

5. Fit wheels to the Steering knuckles.

Installation

1. Refit the wheels.

2. Place the axle assembly under the tractor (ensure the lubricator is to the bottom). Lower the tractor onto the axle lining the holes in the axle support with the pivot pin sleeve hole in the axle centre. Drive in the pivot pin ensuring that the groove pin hole lines up with the hole in the front axle support. Fit the groove pin. When fitting pivot ensure that sufficient shims are fitted to take up all end float in axle beam.

   It is most important that all end float in the front axle is removed by correct shimming, as excessive end float will transmit shocks to the steering gear.

3. Fit the Drag Link to the L.H. steering knuckle, tighten nut and fit cotter pin.

4. Adjust the "Toe-in".

FRONT AXLE

Disassembly and Inspection of Front Axle (Cont'd)

Installation (Cont'd)

5. Reconnect the battery ground lead.

Disassembly and Inspection of Front Wheel Hub

1. Remove the cap and gasket.
2. Undo the castellated nut and remove the retainer.
3. Pull off the hub.
4. Remove from the hub the bearings and cones, etc.
5. From the Steering Knuckle remove the oil Seal, spacer, felt washer, & dust shield.
6. Thoroughly clean all parts with varsol and dry with compressed air.
7. Inspect the bearings and cones for pits, chipping and other signs of damage (i.e. signs of bearing cage failure, etc. Replace bearings and cones as complete assembly only when renewing.
8. Inspect Steering knuckle thread and nut.
9. Inspect the oil seal for further service, replace if necessary (if border line replace).
10. Always replace felt washer and the hub cap gasket.

Reassembly of Front Wheel Hub

1. Press on to the tapered Steering Knuckle shaft, the spacer (smaller dia. outwards).
2. Press on the dust shield (cutway section downwards).
3. Fit the felt washer (well soaked in oil).
4. Fit the oil seal (spring towards felt washer).

STEERING & WHEELS

FRONT AXLE

Reassembly of Front Wheel Hub (Cont'd)

5. Place inner and outer grease retainers in the wheel hub.

6. Press the inner and outer bearing cones into the hub.

7. Grease the inner cone and fit bearing. Now push the hub onto the Steering Knuckle.

8. Fit the outer bearing (grease the cone first).

9. Fit the retainer washer.

10. Tighten the castellated nut to load the bearings. Let off the nut until the retainer washer is free. Adjust so that retainer washer is free but there must be No Rock.

    Fit cotter pin and split.

11. Fit the gasket, fill the hub cap with grease and bolt up.

REAR WHEELS

Removal of Rear Wheels.

1. Jack up rear of Tractor until wheels are just clear of the ground.

2. Remove the rear wheel hub nuts L.H. and R.H. Lift the wheels off the hub bolts.

3. The hub bolts should remain in position in the hub.

4. The rear wheel hubs integral with the rear axles.

REAR WHEELS

Disassembly and Inspection of Rear Wheels.

1. The outer rim and tire can be removed from the inner dished disc by removing the bolts that secure the disc to the rim lugs.

2. Inspect the rim lugs for any signs of damage caused by running with bolts loose.

3. Check that the inner disc and the rim are not eccentric (probably caused by brutal driving and/or very bad field conditions).

Reassembly of Rear Wheels

1. Assemble the inner disc to the securing rim lugs. Rim, tire and disc are then assembled.

TIRES

General

1. Keep inflated to correct pressure for maximum life and performance. This will also assist self cleaning design.

2. Under inflation will damage tire cords and also cause rims to move within the tire damaging the valve stem. Irregular and angular wear at the rear edges of the tread bars can be caused by under inflation.

3. Over inflation results in excessive slippage and rapid tire wear, indicated by irregular angular wear on the front of the tread bars. Stiffens tire which prevents tread from flexing and following ground contour.

STEERING & WHEELS

TIRES

Wear on Rear of Tread Bar.

Under inflation and/or excessive wheel load. This type of wear will show where excessive "road-work" is done.

Wear on Front of Tread Bar.

Over inflation causing slippage.

Over inflation and/or insufficient wheel weight.

Fierce clutch operation or too heavy draft loads.

Wheel slippage.

Tractors are shipped with high tire pressures, to assist rigid blocking and prevent bouncing, reduce to correct pressure before operating tractor.

Mounting Tires

When mounting tires use soap and water as lubricant, over inflate to seat bead square against the rim flange. Deflate to correct pressure.

Care of Tires

Keep tires free from oil and grease. After using chemical sprays, wash tires well with water.

If tractor is to be stored keep "jacked up" and tires away from sunlight, check pressures. Always use valve caps (Keep out dirt, water, ice, gravel, etc., from damaging valve cores).

Water Ballast 75%

1. Secure an adaptor, (bleed valve for air pressure caused by water pumped in).
2. Jack up tire, set valve to top. Remove and release all air.
3. Fit adaptor and proceed to fill, either by pump, gravity tank (5' above) or pressure tank.

TIRES

Care of Tires (Cont'd)

4. Continue until tire filled to valve level. Remove adaptor and inflate to correct pressure.

Water Ballast 100%

Requires special equipment.

Water Ballast-Frost Precaution

25% mixture Calcium Chloride solution protection down to 25°F below zero. (Approx. 20 lbs. $CaCl_2$ to 8½ galls. Water). Can be checked with hydrometer. Specific gravity approx. 1.225.

Caution

When mixing $CaCl_2$ solution Always add $CaCl_2$ to water, Never Reverse. To prevent acid action add lime to the $CaCl_2$ at the rate of 1 lb. lime to 100 lbs. $CaCl_2$. Mix thoroughly and allow to cool before use.

STEERING & WHEELS

STEERING

Cam and Lever Steering Gear

The operation of this design of steering gear is very similar to the screw and nut type. The cam is in effect a helical groove on the steering shaft, in the place of the screw thread in the case of the screw and nut. Instead of the nut screwing up and down the thread on the shaft, a ball peg fixed to the arm of the rocker shaft engages in the helical groove. Therefore as the groove rotates when the steering wheel is turned, the peg travels up and down along the groove according to the way the wheel is turned.

The cam is circular, very similar to a worm and is mounted on the steel steering shaft. The lower end of the steering shaft is supported by two ball bearing races, on either side of the cam. Shims are fitted between the steering housing and bottom cover for the adjustment of the ball bearings. A felt bush acts as a bearing between the shaft and tube at the top end of the steering shaft.

The rocker shaft is in the form of a crank, and is supported in the steering box on two bronze bushes. Riveted to the cranked end of the rocker shaft is a hardened steel peg which engages in the cam. Shims are fitted between the steering box and the side cover for the adjustment of the correct meshing between the peg and cam.